

DEMOGRAPHIC TRANSITION IN THE PAST AND PROJECTED FIVE DECADES IN SUB-SAHARAN AFRICA, 1967-2068: EMPIRICAL EVIDENCE FROM NIGERIA

ABSTRACT

Aims: This study assessed the demographic transition in the past and projected five decades in Sub-Saharan Africa, 1967-2068: Empirical evidence from Nigeria.

Study Design: Past and projected time series data (between 1967 and 2068) were used for the study. The 1967-2068 data sets were resorted to due to lack of complete national data.

Place and Duration of Study: Past (between 1967 and 2017) and projected (between 2018 and 2068) five decades in Nigeria.

Methodology: Interpolated Demographic time series data were obtained from the United Nations Population Division, Department of Economic and Social Affairs, and National Population Commission on Crude Birth Rates, Crude Death Rates and population levels in Nigeria. Data were analyzed using birth and death rate indices, demographic transition index, growth rate equation, and granger causality statistics. Unit root, co-integration and error correction tests were also carried out.

Results: Results showed that in the past five decades (1967-2017), the mean crude birth and death rates per 1,000 populations were 43.9 and 18.0 respectively; while that of the projected five decades (2018-2068) was 28.9 and 7.9 respectively per 1000 populations. The demographic indices showed that in the past five decades (between 1967 and 2017), Nigeria was at the second stage (stage II) of demographic transition, and expected to remain at this stage in the next five decades (between 2018 and 2068). Results also showed that the population growth rate in the past five decades was 2.584 percent, while the growth rate in the next five decades as projected was 2.098 percent. The population growth rate (2.098 percent) in the next five decades (between 2018 and 2068 as projected) is expected to decrease by an average of 0.486 percent. Results also showed that there is a mutual link between demographic transition and population growth.

Conclusion: Nigeria is currently at the second stage of demographic transition, and expected to remain at this stage (stage II) in the next five decades. Demographic transition increases the prediction of population growth, and vice versa.

Keywords: *Demographic transition, Birth rate, Death rates, Female Literacy, Population growth, Nigeria*

1 INTRODUCTION

An important transition in the economic history of countries occurs when they move from a regime of low prosperity, high child mortality and high fertility to a state of high prosperity, low child mortality and low fertility (Ranganathan *et al.*, 2015). Demographic transition is a population theory that relates economic development to patterns of population growth, describing the transition from high birth and

death rates to low birth and death rates (Tumbe, 2016). Population growth is a function of birth, death, immigration and emigration rates (Mohamed and Schachler, 2017). The transition is also an indication of a shift away from a stable and stationary stage of population (Merson, 2006), which begins with a decline in mortality while fertility remains persistently high, and leads to a regime of high population growth (Cahu *et al.*, 2012). An increase in population growth at the start of the demographic transition results from a decline in mortality rates as population health improves, and a later decline in population growth arises from a decline in fertility rates (Tacoli *et al.*, 2014).

Demographic transition is not only consisting of population growth tendency but much more along with economic consequences (Megeri and Kumar, 2018). Demographic transition is a four-stage historical process of population growth; first, high birth rates and high death rates; second, high birth rates and low death rates; and third, low birth rates and low death rates; a fourth stage in which deaths out-number births has made its appearance in the most industrialized nations. In the first stage of demographic transition (in pre-industrial society), death rates, and birth rates are high and roughly in balance (fluctuated rapidly according to natural events, such as famine, drought, and disease). During this agricultural revolution, birth and death rates both tend to be very high in this stage and because both rates are approximately in balance, population growth is typically very slow in stage one. In the second stage, death rates drop rapidly owing to improvements in food supply and sanitation, which increase lifespan and reduce disease. The improvements specific to food supply typically include selective breeding and crop rotation and farming techniques. Other improvements generally include access to technology, basic health care, and education. Countries in this stage experience a large increase in population, as death rate decline without a corresponding fall in birth rate (Henslin, 2009).

In stage three, birth rates fall owing to access to contraception, increases in wages, urbanization, a reduction in subsistence agriculture, an increase in the status and education of women, a reduction in the value of children's work, an increase in parental investment in the education of children and other social changes (Myrskylä *et al.*, 2009), hence population growth begins to level off. The fourth stage (corresponding to contemporary societies) is characterized by low birth rates and low death rates as observed in advanced economies (Baudelle and Olivier, 2006). Birth rates drop to well below replacement level, as it is happening in countries like Germany, Italy, and Japan, leading to a shrinking population, a threat to many industries that rely on population growth. Death rates may remain consistently low or increase slightly as a result of increases in lifestyle diseases arising from low exercise levels, high obesity and an aging population in developed countries.

Some theorists argue that a fifth stage is needed to represent countries that have sub-replacement fertility (that is, below 2.1 children per woman). Most European and many East Asian countries now have higher death rates than birth rates. In this stage, population aging and population decline will eventually occur to some extent if mass migration does not occur. However, some theorists submitted that there may be a further stage of demographic development. According to Myrskylä *et al.* (2009), advances in developments reverse fertility declines, indicating that previously negative relationship between national wealth (as measured by the Human Development Index (HDI)) and birth rates have become J-shaped. Development promotes fertility decline at low and medium HDI levels, but advanced HDI promotes a rebound in fertility. In many countries with very high levels of development fertility rates are now approaching two children per woman, although there are exceptions, notably in Germany and Japan (Myrskylä *et al.*, 2009).

Each stage of demographic transition and the resulting increase in population growth is marked with opportunities and challenges. Whether population dynamics pose challenges or bring opportunities depends largely on the policies that are in force (UNFPA, 2013). Sub-Saharan Africa (SSA) has experienced, and is projected to experience, rapid population growth from 183 million in 1950 to 863 million in 2010 and 1,753 million in 2050 (Eastwood and Lipton, 2011). Population increase in some Sub-Saharan African countries, as demographic transition occurs, has limited social and economic development as many of the virtuous mechanisms linking demographic transition to social change and development are slowed down. Binswanger-Mkhize and Savastano (2016) reported that increase in population has led to unsustainable production practices due to the need to satisfy the growing demand for food and other land resources. At extreme cases, the transition and corresponding rise in population produces social stresses such as hunger due to low productivity and loss of arable lands. Population dynamics do not only pose challenges, they also provide important opportunities for more sustainable development. A fall in fertility levels and slower population growth,

for example, leads to an increased concentration of the population in the working age range, which can enable countries to reap a demographic bonus and jumpstart economic development (UNFPA, 2013).

1.1 Objectives of the Study

The broad objective of the study was to assess the demographic transition in the past and projected five decades in Sub-Saharan Africa, 1967-2068: empirical evidence from Nigeria. The specific objectives were to;

- i. determine the stage of demographic transition in the past five decades in Nigeria,
- ii. ascertain the stage of demographic transition in the next projected five decades in the country,
- iii. assess the level of population growth as demographic changes occur in the country,
- iv. determine the relationship between demographic transition and population growth rate in the country, and make policy recommendations.

1.2 Hypotheses of the Study

The null hypotheses tested were that;

- i. Demographic transition does not cause population growth in the country
- ii. Population growth does not cause demographic transition in the country

2 METHODOLOGY

2.1 Study Area

Nigeria where this study was carried out is located in West Africa on the Gulf of Guinea and has a total area of 923,768 km² (Ocean Data and Information Network for Africa ODINAFRICA, 2014). The country is bordered in the south by approximately 800km of the Atlantic Ocean, on the West by the Republic of Benin, on the North by the Republic of Niger and Republic of Cameroun on the East (National Bureau of Statistics NBS, 2007). Nigeria lies between Latitudes 4° and 14°N and Longitudes 2° and 15°E (World Fact Book, 2011). There are 36 states and the Federal Capital Territory Abuja. The states are aggregated into six geopolitical zones: North West, North East, North Central, South East, South South and South West (Federal Research Division, 2008). The country's population is about 201.3 million persons (World Bank and United Nation Population Division, 2019). Of the urban population, 27 per cent is food insecure, compared to 44 per cent of the rural population. Socio-cultural barriers still impede many healthy household practices; the rate of exclusive breastfeeding is just 15 per cent, and only 49 per cent of babies are delivered by skilled attendants (UNICEF, 2013).

Under-five mortality fell from 201 deaths per 1,000 live births in 2003 to 124 per 1,000 in 2011, while infant mortality fell from 100 to 78 per 1,000 between the same referenced years. The maternal mortality ratio has improved, dropping from 800 per 100,000 live births in 2000 to 630 per 100,000 live births in 2011 (NPC, 2011). The main causes of infant and child deaths are pneumonia, diarrhoea, malaria and neonatal causes, compounded by under-nutrition and vaccine-preventable diseases. The poorest population quintile has an under-five mortality rate of 220 per 1,000 births, compared to 90 per 1,000 among the richest quintile (NPC, 2011). Total fertility rates in Nigeria have assumed a downward trend from an average of 6 children per woman in 1990 to 5.5 in 2013 (Akinyemi and Isiugo-Abanihe, 2014). Within the population, the age structure comprised 0-14 years, 15-24 years, 25-54 years, 55-64 years, and 65 years and over. The proportion of the population of the age structure estimates for the 2012 for the age cohort of 0-14 years was 43.9%; 19.3% for the age cohort of 15-24 years; 30% for the age cohort of 25- 54 years; 3.8% for the age cohort of 55-64 years; and 3% for the age cohort of 65 years and over (World Factbook, 2013). The projections for birth rate in Nigeria showed 39.23 births/1,000 persons and the death rates showed 13.48 deaths/1,000 persons (World Factbook, 2012). The country is fraught with higher level of population pressure on agricultural resources which questioned its sustainability. However, given the country's high population, per capita GDP was only USD2,980 in 2013, ranking 131st in the world compared to South Africa which had a per capita GDP of USD6,886 at 88th, according to the World Development Indicators (World Bank 2015).

2.2 Analytical Techniques

2.2.1 Stage of Demographic Transition in the Past and Projected Decades in Nigeria

The past and projected stage of demographic transition in the study area was analysed using the Descriptive Statistics, Birth and Death Rate Indices. In this case, the birth and death rates resulting in a given level of population growth were used to describe the stage of demographic transition in the country. Following Henslin (2009) and other demographers, there are four common demographic stages based on the following decision rule:

- Stage 1:** High Births + High Deaths = Stable population at low level.
- Stage 2:** High Births + Low Deaths = A growing population with spreading age base.
- Stage 3:** Low Births + High Deaths = A declining population.
- Stage 4:** Low Births + Low Deaths = Stable population but aging.

The models are stated as:

$$Br_t = \frac{\text{Total live births}}{\text{Total population}} \times 1000 \quad 1$$

While,

$$Dr_t = \frac{\text{Total deaths}}{\text{Total population}} \times 1000 \quad 2$$

Where,

Br_t = Birth rate for the time period, t (in number per 1000)

Dr_t = Death rate for the time period, t (in number per 1000)

The past and projected stages of demographic transition were therefore determined as:

$$DT_t = \frac{Br_t}{Dr_t} \times 100 \quad 3$$

- a) $DT = 100\% \Rightarrow$ **Stage 1**, if:
- i. High Birth + High Death (for High values of birth and death)
 - = > **Stage 4**, if:
 - ii. Low Birth + Low Death (for low values of births and death)

b) $DT > 100\% \Rightarrow$ **Stage 2** (High Birth + Low Death)

c) $DT < 100\% \Rightarrow$ **Stage 3** (Low Birth + High Death)

Where,

Br_t = Birth rate for the time period, t (in number per 1000)

Dr_t = Death rate for the time period, t (in number per 1000)

DT_t = Demographic transition for the time period, t (percent)

2.2.2 Level of Population Growth due to Demographic Transition

The level of population growth due to demographic transition was determined using the growth model stated as in Jebweb, Christiaensen and Gindelsky (2014):

$$K = \left[\left(\frac{g_{t+1}}{g_t} \right)^{\frac{1}{m}} - 1 \right] \times 100 \quad 4$$

Where,

K = Population growth rate (percent)

m = Time interval (years)

g_{t+1} = Population in the next projected five decades (number)

g_t = Population in the last five decades (number)

This geometric model was used because the population is believed to increase in a geometric fashion.

2.2.3 Relationship between Demographic Transition and Population Growth Rate

The Granger causality statistics was used to ascertain the relationship between demographic transition and population growth rate. In this case, the directionality of the Granger-causality between demographic transition and population growth rate is established. The primary model in Vector Autoregressive Regression forms are stated as in Gujarati and Dawn (2009):

$$Y_t = \alpha_0 + \alpha_1 \sum_{i=1}^n Y_{t-1} + \alpha_2 \sum_{i=1}^n X_{t-1} + \mu_t \quad 5$$

$$X_t = \beta_0 + \beta_1 \sum_{i=1}^n X_{t-1} + \beta_2 \sum_{i=1}^n Y_{t-1} + \varepsilon_t \quad 6$$

Where,

Y_t = demographic transition over time (ratio of Births and Deaths)

X_t = rate of population growth over time

t = time trend

α and β , = estimated parameters

μ_t and ε_t = error terms

In equations (5) and (6), If $\alpha_2 \neq 0$ and $\beta_2 = 0$, there is a bilateral Granger causality between demographic transition and population growth. However, If $\alpha_2 = 0$ and $\beta_2 \neq 0$, there is Granger causality between demographic transition. On the other hand, If $\alpha_2 \neq 0$ and $\beta_2 \neq 0$, the causality is considered as mutual or bi-directional. In addition, there is no link between the demographic transition If $\alpha_2 = 0$ and $\beta_2 = 0$.

2.3 Test of Hypotheses

Hypotheses of the study were realized from the results of objective (iv) using the Granger Causality Test

3 RESULTS AND DISCUSSION

3.1 Stage of Demographic Transition in the Past Five Decades in Nigeria

Table 1 shows the estimated stage of demographic transition in the past five decades in Nigeria. Results showed that in the past five decades (1967-2017), the mean crude birth and death rates per 1,000 populations were 43.9 and 18.0 respectively, with 243.9% transition in the country. This implies that the birth rate in the past five decades was higher than death rates with 243.9% transitions above the 100% benchmark. Since the transition is above 100% benchmark, following Henslin (2009) and Demographic Transition Model, this is an indication of high births and low deaths (Birth rate was higher than death rate). This shows that in the past five decades (from 1967 to 2017), the country was at the second stage of demographic transition (stage II). In the second stage of demographic transition, the death rate declines without a corresponding fall in birth rates. This in turn produces an imbalance in births and deaths. Countries in this stage experience a large increase in population.

This also implies that the country had moved out of the first stage (stage I) of demographic transition, where death and birth rates are high and roughly in balance (fluctuated rapidly according to natural events, such as famine, drought, and disease). Birth and death rates both tend to be very high in stage one and because both rates are approximately in balance, population growth is typically very slow.

Table 1: Estimated Stage of Demographic Transition in the Past Five Decades (1967-2017)

| Items | Past Five Decades (1967-2017) |
|--|-------------------------------|
| Crude Birth Rate | 43.9 |
| Crude Death Rate | 18.0 |
| Demographic Transition (DT) | 2.439 |
| DT% | 243.9 |
| Stage of Demographic Transition | Stage II |

Source: Data from the United Nations Population Division, Department of Economic and Social Affairs (2017). Interpolated Demographic Data and STATA Computed, 2018.

3.2 Stage of Demographic Transition in the Next Projected Five Decades in Nigeria

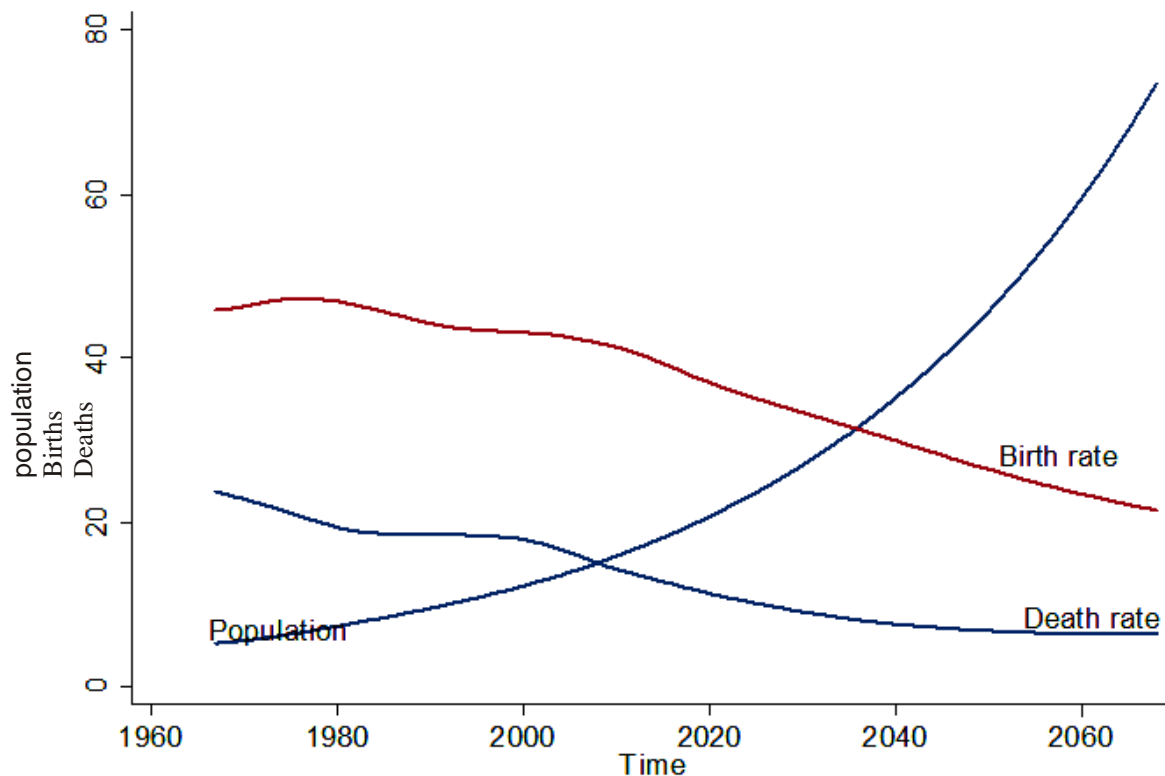
Table 2 shows the estimated stage of demographic transition in the next projected five decades in Nigeria. Results also showed that the crude births and deaths per 1,000 populations for the projected five decades (2018-2068) were 28.9 and 7.9 respectively, with expected transition of 365.8%. This implies that the birth rate in the next projected five decades will be higher than death rate with 365.8% transitions above the 100% benchmark. This also indicates that the country will still be at the second stage (stage II) of demographic transition in the next five decades (from 2018 to 2068).

Table 2: Projected (Future) Stage of Demographic Transition in Nigeria

| Items | Projected Five Decades (2018-2068) |
|--|---|
| Crude Birth Rate | 28.9 |
| Crude Death Rate | 7.9 |
| Demographic Transition (DT) | 3.658 |
| DT% | 365.8 |
| Stage of Demographic Transition | Stage II |

Source: United Nations Population Division, Department of Economic and Social Affairs (2017). Interpolated Demographic Data and STATA Computed, 2018.

The past and projected stage (stage II) of demographic transition in the country is an indication of a growing population with spreading age base. Figure 1 illustrates the second stage of demographic transition in the past and projected five decades in Nigeria, showing high birth and low death rates, and a population which increases at an increasing rate. The rapid drop in death rates could be linked to the improvements in public health care services, sanitation and food supply, which in turn reduce disease and increase lifespan. This is in line with the report of Henslin (2009) for developing countries, Nigeria inclusive. The improvements in health care services and food supply could be attributed to the provision of basic health care services, portable water, improvements in personal hygiene and general health education, use of improved breeds and crop varieties, and access to technology in the country. The progress in public health and food supply therefore decreased child mortality, which stems from the improvement in antenatal services and increase in female literacy. According to Canning *et al.*(2015), educating women increases their ability to make decisions about their own and their children's health, their ability to access and use family planning methods, their bargaining position within the household, and their incentive to work. Speeding up demographic transition in Sub-Saharan Africa, Nigeria inclusive, according to Cillier (2018) requires concerted actions such as accelerated roll-out of modern contraception use that soaks up and then goes beyond the pent-up demand; female empowerment and, in particular, eliminating gender inequality in education and boosting female enrolment and graduation rates to those of males at primary, secondary and tertiary levels; and improved health of women and children by investing in basic infrastructure such as the provision of clean water and improved sanitation.



Source: United Nations Population Division, Department of Economic and Social Affairs (2017). Interpolated Demographic Data and STATA Computed, 2018

Figure 1: Illustration of the Second Stage of Demographic Transition in the Past and Projected Five Decades in Nigeria

3.3 Level of Population Growth Due to Demographic Changes

Table 3 shows the estimated population growth rate resulting from demographic changes in the past (1967-2017) and projected (2018-2068) five decades in Nigeria. Results showed that the population growth rate in the past five decades (1967-2017) was 2.584 percent, while the projected growth rate in the next five decades (2018-2068) was 2.098 percent. This implies that the demographic changes in the past five decades (1967-2017) increased the population level by 2.584%, and it is expected that the population growth rate (2.098%) in the next five decades (from 2018 to 2068, as projected) will decrease by an average of 0.486% as shown in figure 2. Figure 2 showed that the population growth rate rose at an increasing rate between 1967 and 1976, got to its maximum in 1977 and decreased at a decreasing rate between 1978 and 1983. The figure also showed that the projected population growth rate between 2018 and 2068 is expected to decrease at a decreasing rate. This could be linked to the birth rate which increases at a decreasing rate (as shown in figure 1), resulting from the increase in female literacy, education and social status. This is in line with Sheikh and Loney (2018) that linked the decreasing trend of total fertility rate to the increase in female literacy. According to Ghosh *et al.* (2015), improvements in education play a role in ameliorating fertility choices in females.

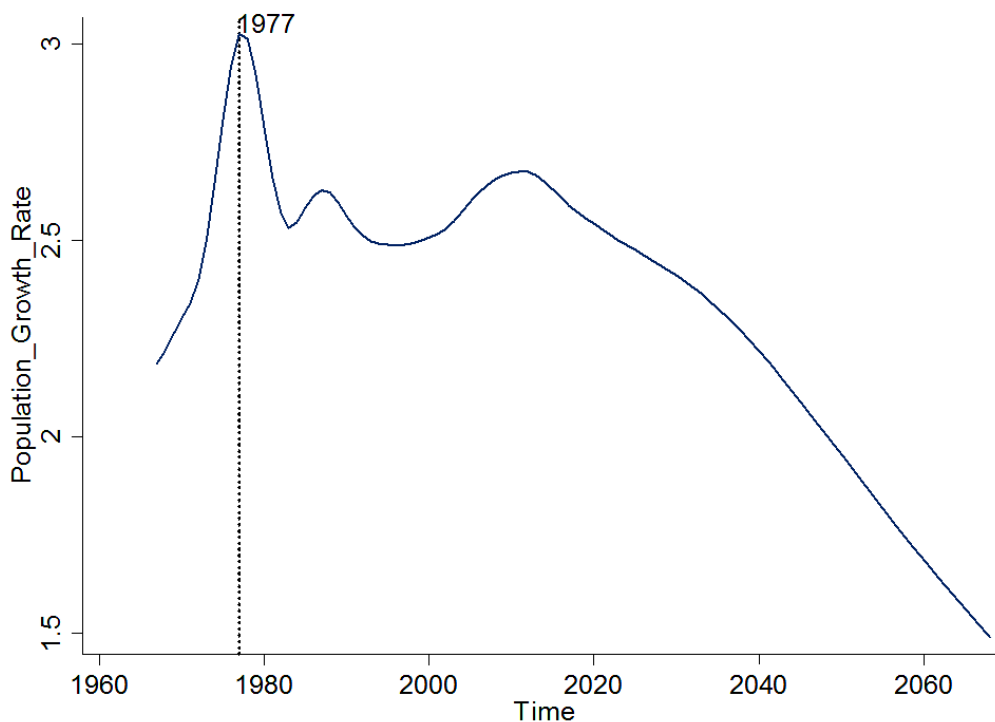
A lower fertility rate is often correlated with greater wealth and education (Murphy, 2013). According to Aldieri and Vinci (2012), highly educated women tend to marry late compared to lesser educated women, and have a higher age at first birth, and fewer children. They are more likely to be aware of modern contraceptives and to adopt new birth-control methods (Kim, 2016). Women's higher education empowers them to make decisions on their fertility (Chicoine, 2012). Gakidou *et al.* (2010) reported that increasing female education changes the dynamics of family formation as it shortens the total reproductive life of a woman leading to a decreased Total Fertility Rate. These demographic changes such as a decline in child mortality, structural changes to the economy, and a rise in women's status and opportunities, resulting from modernization have all contributed to a very substantial reduction in total fertility rates and hence in population growth (Cilliers, 2018). Fertility

issue reflects the extent to which people have the power and the means to make their own choices about the number, timing and spacing of pregnancies, and matters for societies because it can impede or accelerate progress towards greater prosperity, equitable and sustainable development, and well-being for all (United Nations Population Fund, UNFPA, 2018). As reflected in the 2030 Agenda for Sustainable Development, reproductive health and reproductive rights are specific aims under one of the 17 Sustainable Development Goals, and integral to realizing all the goals.

Table 3: Population Growth Rate in the past (1967-2017) and projected (2018-2068) Five Decades in Nigeria

| Time Interval (50 years) | Average Population Growth Rate (%) |
|-----------------------------|------------------------------------|
| 1967-2017 | 2.584 |
| 2018-2068 | 2.098 |
| Difference | -0.486 |

Source: United Nations Population Division, Department of Economic and Social Affairs (2017). Interpolated Demographic Data and STATA Computed, 2018



Source: United Nations Population Division, Department of Economic and Social Affairs (2017). Interpolated Demographic Data and STATA Computed, 2018

Figure 2: Illustration of Population Growth Rate over time in Nigeria

3.4 Relationship between Demographic Transition and Population Growth Rate

Unit Root Tests

Table 4 shows the results of the three Dickey Fuller (DF) models with intercept, no trend/no intercept and trend/intercept, for the unit root tests for demographic transition and population growth rate. The three Dickey Fuller models confirmed that the time series variable demographic transition was stationary at 1%, 5% and 10% levels, while population growth rate at its level has t-value (ADF test statistics) less than the critical values at 1%, 5% and 10%. This therefore results to accepting the null hypothesis that the population growth rate has unit root in the series. This implies that the variable, population growth rate, is non-stationary. Results showed that taking the third difference of population growth and no difference of demographic transition, increased the t-values (ADF test Statistics), which were greater than the critical values at 1%, 5% and 10% levels, respectively for the three DF models.

This however leads to the conclusion that population growth is integrated of order three, while demographic transition is integrated of order zero. This results to the rejection of the null hypothesis and the acceptance of the alternative that both series have no unit root, and are stationary.

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Table 4: Results of ADF Unit Root Tests for Demographic Transition and Population Growth Rates

| Variables | Model 1 (Intercept) | | | Model 2 (No trend, no intercept) | | | Model 3 (Trend and Intercept) | | | Order of Differencing | | | |
|---------------------------|------------------------|-----------------|-------|-------------------------------------|------------------|-----------------|----------------------------------|-------|------------------|--------------------------|-----------------|-------|------|
| | ADF Statistic | Critical Values | | | ADF Statistic | Critical Values | | | ADF Statistic | | Critical Values | | |
| | | 1% | 5% | 10% | | 1% | 5% | 10% | | | 1% | 5% | 10% |
| Demographic Transition | -3.68 | -3.51 | -2.89 | -2.58 | 3.68 | -2.60 | -1.95 | -1.61 | 5.08 | -4.04 | -3.45 | -3.15 | I(0) |
| Population Growth | -4.29 | -3.51 | -2.89 | -2.58 | -4.31 | -2.60 | -1.95 | -1.61 | -4.26 | -4.04 | -3.45 | -3.15 | I(3) |

Source: STATA 14 Output, 2018

Johansen Co-integration Tests

Table 5 shows the results of Johansen co-integration tests for demographic transition and population growth rate. Results showed that for none (0) hypothesis (there is no co-integrating model), the Trace statistics (44.443) and Max statistic (43.387) values were significant at 5% critical. Therefore, the null hypothesis that there is no co-integrating model was rejected since the Trace and Max statistic values are greater than the 5% critical value. Results also showed that for at most one co-integrating hypothesis (at most 1), the Trace (1.0456) and max (1.0456) were not significant at 5% critical levels. Therefore, the null hypothesis that there is one co-integrating model was accepted. This implies that demographic transition and population growth rate are co-integrated, and have long run equilibrium relationship.

Table 5: Results of Johansen Co-integration Tests for Demographic Transition and Population Growth Rate

| Hypotheses | Trace Statistics | | Max Statistics | | H ₀ : Decision |
|------------|------------------|-------------|----------------|-------------|---------------------------|
| | Value | 5% Critical | Value | 5% Critical | |
| None (0)* | 44.433 | 15.41 | 43.387 | 14.07 | Rejected |
| At most 1 | 1.0456 | 3.76 | 1.0456 | 3.76 | Accepted |

*significant at 5%

Source: STATA 14 Output, 2018

Error Correction Mechanism

Table 6 shows the long run and short run causality between demographic transition and population growth rate in the country. Results showed that the error correction (EC) coefficient (-2.54) was negative and statistically significant at 1% level. This is an indication of long run causality running from demographic transition to population growth at a speed of 2.54% annually. The error correction coefficient represents the long run equilibrium between demographic transition and population growth rate. It also shows the rate at which it corrects the previous period disequilibrium of the system, and the rate at which the system restores back to equilibrium. This implies that the system corrects the previous period disequilibrium (speed of adjustment) at a speed of 2.54% annually. Results also showed that the short run coefficient (0.313) was positive and statistically significant at 10% level. This is an indication of short run equilibrium. It implies that in the short run, the system corrects its previous period disequilibrium at a speed of 0.313% between population growth and demographic transition. The chi-square value (69.45) of the post estimation test which was significant at 1% level further confirmed that there is a short run causality running from demographic transition and population growth rate, at a speed of 0.313% per annum. However, the diagnostic check for autocorrelation showed that the chi-square value (6.117) was not significant. Therefore, the null hypothesis that there is no autocorrelation was accepted. This implies that there is no autocorrelation at lag order specified. The chi-squared values of demographic transition (1.006) and population growth rate (0.118) for the Jarque-Bera test for normally distributed disturbances were not significant. Therefore, the null hypothesis that residual is normally distributed was accepted.

Table 6: Long run and Short run Causality between Demographic Transition and Population Growth Rate

| Equation (lag 24) | coefficient | t-statistics | P-value |
|-------------------|-------------|--------------|---------|
| Long run (EC) | -2.5371* | -3.75 | 0.000 |
| Short run | 0.31317** | 1.76 | 0.066 |

Post estimation test for Short run Causality

Chi-square (lag 23) 69.45
 Prob>chi-square 0.0000

Diagnostic Test for Autocorrelation

| Lag | Chi-square | P-value |
|-----|------------|---------|
| 24 | 6.117 | 0.48252 |

Jarque-Bera Test for Normally Distributed Disturbances

| Variables | Chi-squared | P-value |
|------------------------|-------------|---------|
| Demographic Transition | 1.006 | 0.215 |
| Population Growth | 0.118 | 0.415 |
| All | 1.124 | 0.332 |

*significant at 1%, **significant at 10%

Source: STATA 14 Output, 2018

Table 7 shows the granger causality Wald tests for the relationship between demographic transition and population growth. The p-values showed that Demographic transition and all variables were significant at 1% levels, respectively. Therefore, the null hypothesis that lagged demographic transition does not granger causes population growth in the country was rejected. This led to the conclusion that lagged demographic transition granger causes population growth in the country. However, the p-values also showed that population growth and all variables were significant at 1% levels, respectively. Therefore, the null hypothesis that lagged population growth does not granger causes demographic transition in the country was also rejected. This also led to the conclusion that lagged population growth granger causes demographic transition in the country. This is an indication that there is a bi-directional causality between demographic transition and population growth rate. This implies that there is a mutual link between demographic transition and population growth, and demographic transition increases the prediction of population growth, and vice versa in the country.

Table 7: Granger Causality Wald Tests for the Relationship between Demographic Transition and Population Growth.

| Equations | Excluded | Chi-Square | P-value` |
|------------------------|------------------------|------------|----------|
| Population Growth | Demographic Transition | 175.62 | 0.000 |
| Population Growth | All | 175.62 | 0.000 |
| Demographic Transition | Population Growth | 43.47 | 0.000 |
| Demographic Transition | All* | 43.47 | 0.000 |

Source: STATA 14 Output, 2018

4 CONCLUSION

Nigeria is currently at the second stage of demographic transition, and expected to remain at this stage (stage II) in the next five decades as births continue to be higher than deaths. The demographic changes (in the past five decades) resulting from a decline in death rates without a corresponding drop in birth rates, results to a large increase in population overtime in the country. The population growth rate however is expected to decrease in the next five decades. Finally, there is a mutual link between demographic transition and population growth, and demographic transition increases the prediction of population growth, and vice versa in the country.

5 RECOMMENDATIONS

Considering the fact that the country has been in stage two of demographic transition for the past five decades, and expected to remain at this stage in the next five decades, policy makers should focus on programmes that will speed up the demographic transition to the next stage, through effort to reduce

fertility rates. This will enable Sub-Saharan African countries, Nigeria inclusive to reap a demographic bonus and jumpstart economic development. Perhaps, issues relating to improving female literacy, raising access to comprehensive family planning services and overall health service delivery to stem mortality, may be very pertinent in this connection.

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